Air Compressor Storage Tanks SPP# 1910.169

Quick Reference

1.0 Purpose

The purpose of this safety policy and procedure is to establish guidelines for the protection of North Carolina Department of Transportation (NCDOT) employees working with or on compressed air equipment.

2.0 Scope and Applicability

Air compressors are used for a variety of applications in NCDOT. Air compressor storage tanks store excess air that is generated from the compressor. Thus, air compressor storage tanks provide a convenient and readily accessible air source. However, because of the air pressure within these storage tanks, potential dangers can develop if certain practices and precautions are not followed.

This safety policy and procedure provides guidelines for the safe use of air compressor storage tanks. It includes provisions for training, discussion on where these air compressor storage tanks are used, and guidelines for locating drains and traps on air compressor storage tanks. Additionally, it presents requirements for gauges and valves and installation of gauges, valves, drains and traps.

This document also details the areas of responsibility for managers/unit heads, supervisors, employees, and Safety and Loss Control within NCDOT.

This safety policy and procedure applies to NCDOT employees who, as a result of their job duties, are exposed to or use Air Compressor Storage Tanks.

3.0 Reference

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry (29 CFR 1910.169) and Occupational Safety and Health Standards for Construction Industry (29 CFR 1926.306).

4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, NCDOT will not tolerate malfunctioning air compressor storage tanks that are a threat to employee safety. When these hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Air Compressor Storage Tanks will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure on Air Compressor Storage Tanks. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or condition to his or her supervisor. Specific responsibilities are found in Section 6.3.

6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies specific responsibilities required by NCDOT's safety policy and procedure on Air Compressor Storage Tanks.

6.1 Definitions

Air Compressor Storage Tank
Pressurized vessel that stores air generated from an air compressor.

Drain Valve
A valve that is installed at the lowest point of an air compressor storage tank to provide for the removal of accumulated oil and water.

Trap
A device which uses venting head pressure to purge the tank from condensed water.

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6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- Applications
- Drains and Traps
- Gauges and Valves
- Installation Requirements

6.2.1 Training

Affected employees will be trained in:

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- The purpose of air compressor storage tanks
- The basic operation of air compressor storage tanks
- Maintenance requirements of drains and traps
- Reading gauges and operating valves
- Identifying damage and defects in the storage tanks

This training shall be performed upon initial employment and/or job reassignment. Periodic refresher training shall also be conducted at the discretion of the supervisor.

6.2.2 Applications

Air compressor storage tanks are typically used for tire inflation, pneumatic tool use, hoisting, and chipping. All air compressor storage tanks shall be operated and maintained in accordance with industry standards.

6.2.3 Drains and Traps

Drain valves must be located beneath a tank at the lowest point on all new equipment. Drain valves must be opened once a week to purge water build-up unless they are automatically operated traps.

6.2.4 Gauges and Valves

All air compressor storage tanks shall be equipped with a least one safety valve and pressure gauge. Gauges and safety valves will be tested at least every six months to ensure proper operation.

No valve of any type shall be placed between the air receiver and its safety valve.

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6.2.5 Installation Requirements

Air compressor storage tanks shall be installed such that all drains, handholes, and manholes are easily accessible. Air compressor storage tanks shall never be buried underground or located in an inaccessible place.

6.3 Specific Responsibilities

6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available for the purchase and repair of air compressor storage tanks in their areas. Additionally, they will be responsible for identifying the employees affected by this safety policy and procedure.

Managers/Unit Heads will obtain and coordinate the required training for affected employees. Managers/Unit Heads will also ensure proper use and maintenance through regular standard audits of air compressor storage tanks.

6.3.2 Supervisors

Supervisors will ensure that only those employees who have been trained to work with air compressor storage tanks will be allowed to operate such equipment.

Supervisors will ensure that equipment as needed is available and is in good working condition. If the equipment is not in good working condition, they will ensure that such equipment is repaired.

Supervisors will ensure that air compressor storage tanks are inspected every six months and that employees are provided with Personal Protective Equipment (PPE) as necessary for their job. Appendix A provides a generic checklist for use by supervisors.

6.3.3 Employees

Employees will inspect air compressor storage tanks prior to use and note any damage or defects. Employees shall immediately report any damages or defects to their supervisors. Employees will empty manual drains and taps on a regularly scheduled basis.

6.3.4 Safety and Loss Control

Safety and Loss Control will provide prompt assistance to managers/unit heads, supervisors, or others as applicable as necessary on any matter concerning this safety policy and procedure. Additionally, Safety and Loss Control will assist in developing or securing required training.

Safety and Loss Control will also work with Purchasing and Central Equipment Unit to ensure that all newly purchased air compressor storage tanks comply with current safety regulations.

Safety Engineers will provide consultative service and audit assistance to ensure effective implementation of this safety policy and procedure.

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APPENDIX A: Air Compressor Storage Tank Checklist

Air Compressor Storage Tank Location _____

Air Compressor Storage Tank ID#_____

Air Compressor Storage Tank Manufacturer ID#_____

Maximum allowable working pressure of the air compressor storage tank (PSI)_____

Yes	No	
o	o	Are all drains, handles, and manholes easily accessible?
o	o	Is a drain pipe and valve installed on the lowest point of the air compressor storage tank?
o	o	Is the drain valve opened and frequently drained to prevent the accumulation of excessive amounts of liquids?
o	o	Does the air compressor storage tank have a pressure gauge?
o	o	Do the safety valves operate to prevent the internal tank pressure from exceeding 10% beyond the maximum allowable working pressure of the air compressor tank?

Compressed Gas Cylinders SPP# 1910.101

Quick Reference

1.0 Purpose

The purpose of this safety policy and procedure is to establish guidelines for the protection and safety of North Carolina Department of Transportation (NCDOT) employees who handle and use compressed gases.

2..0 Scope and Applicability

Compressed gases are typically stored under pressure in metal cylinders. These cylinders are designed and constructed to withstand high pressures. Improper handling and use of compressed gases can result in devastating consequences.

This safety policy and procedure provides guidelines for the safe handling and use of compressed gases. It includes provisions for training and presents safe handling guidelines. It also presents the types, uses, inspection, and marking requirements of compressed gas cylinders. Additionally, this safety policy and procedure presents transportation and storage requirements for compressed gas cylinders.

This safety policy and procedure also details the areas of responsibility for managers/unit heads, supervisors, employees, Safety and Loss Control, Purchasing, and Central Equipment Unit within NCDOT.

This safety policy and procedure affects any employee who as a result of his or her job duties is exposed to or handles compressed gas cylinders.

3.0 Reference

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry (29 CFR 1910.101-104).

4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, compressed gas cylinders will not be handled until employees have been trained concerning their use. When hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Compressed Gas Cylinders will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation of NCDOT's safety policy and procedure on Compressed Gas Cylinders. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or condition to his or her supervisor. Specific responsibilities are outlined in Section 6.3.

6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies responsibilities required by NCDOT's safety policy and procedure on Compressed Gas Cylinders.

6.1 Definitions

Compressed Gas (Nonliquefied)
A gas, other than a gas in solution, which under the charging pressure is entirely gaseous at a temperature of 70^{O}F.

Cylinder
A portable compressed gas container, fabricated to or authorized for use by the U.S. Department of Transportation (DOT), or fabricated to Transport Canada (TC) or the "Rules for the Construction of Unfired Pressure Vessels," Section VIII, ASME *Boiler & Pressure Vessel Code.*

Flammable Gas
A gas that is flammable in a mixture of 13 percent or less (by volume) with air, or the flammable range with air is wider that 12 percent regardless of the lower limit, at atmospheric temperature and pressure.

Handling
Moving, connecting, or disconnecting a compressed or liquefied gas cylinder.

Inside Diameter (I.D.)
Inside cylinder diameter.

Liquefied Gas
A gas, which under charging pressure, is partially liquid at a temperature of 20^{o}C (70^{o}F).

Nonflammable Gas
A gas that does not meet the definition of a flammable gas.

Outside Diameter (O.D.)
Outside cylinder diameter.

Oxidizing Gas
A gas that can support and accelerate combustion of other materials.

Safety Relief Device
A device intended to prevent rupture on a cylinder under certain conditions of exposure.

Standard Cubic Foot (SCF)
One cubic foot of gas at 70^{o}F (21^{o}C) and 14.7 psia (an absolute pressure of 101 kilo pascals [kPa]).

Storage
An inventory of compressed or liquefied gases in containers that are not in the process of being examined, serviced, refilled, loaded, or unloaded.

Toxic Gas
A gas having a health hazard rating of 3 or 4 defined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials.*

Use
The consumption of a compressed or liquefied gas in a nonrecoverable manner.

User
An individual, group, or organization who utilizes the compressed or liquefied gas in a nonrecoverable manner.

Valve Protection Device
A device attached to the neck ring or body of the cylinder for the purpose of protecting the cylinder valve from being struck or damaged from impact resulting from a fall or an object striking the cylinder.

Valve Protective Cap
A rigid, removable cover provided for compressed gas container valve protection.

6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- General Safe Handling Guidelines
- Types
- Use
- Inspection
- Marking
- Transportation
- Storage
- Cylinder Protection
- Service

6.2.1 Training

Employees who use and handle compressed gas cylinders will be trained before initial job assignment and/or job reassignment. Employees will be trained in the safe use, inspection, handling, and storage of compressed gas cylinders. Refresher training shall be provided at the discretion of the supervisor.

6.2.2 General Safe Handling Guidelines

Serious accidents can result from the misuse, abuse, or mishandling of compressed gas cylinders. Employees assigned to the handling of cylinders under pressure should follow general safe handling guidelines. Appendix A presents these guidelines. Figure 1 presents the typical components of a compressed gas cylinder.

6.2.3 Types

Compressed gas cylinders are used for a variety of gases in NCDOT. These gas cylinders fall into the following categories:

- Flammable
- Toxic and Poison
- Liquid

The flammable gas cylinder predominantly used in NCDOT is acetylene. Acetylene is used in torch heating, welding, and ferrous metal cutting operations.

Toxic and poison gas cylinders are used in a variety of applications within NCDOT. Methyl Bromide is the most common of these gas cylinders. These cylinders should be marked with a poison gas label.

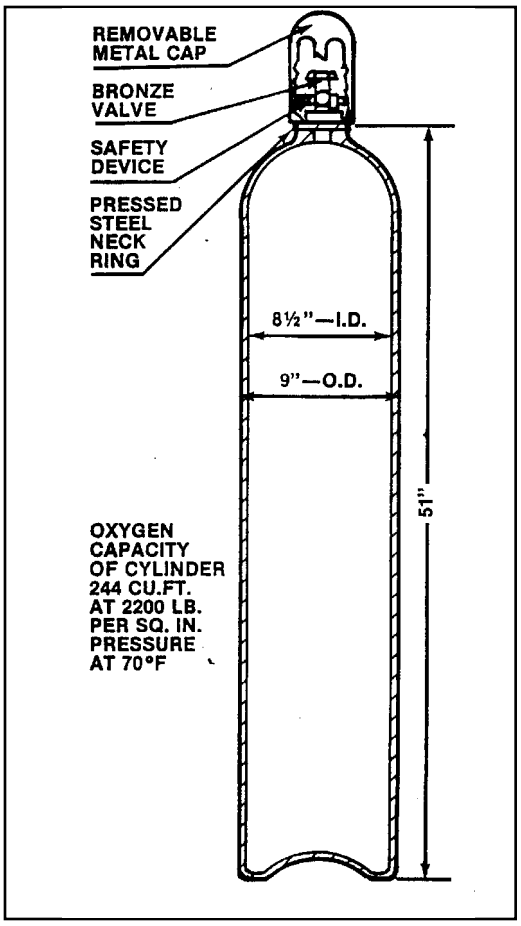

Figure 1

6.2.4 Use

Compressed gas cylinders are used for variety of purposes in NCDOT. Compressed gas cylinders in NCDOT are commonly used in metal cutting operations. Cylinders should be handled carefully and only used for their designated purpose. See SPP# 1910.252, Welding, for additional related information.

6.2.5 Inspection

Compressed gas cylinders should be visually inspected daily for leaks, cracks, etc. This visual inspection will include the cylinder, safety relief devices, valves, protection caps and stems. If a cylinder is thought to be defective, it should be returned to the supplier for replacement. Under no circumstances should employees attempt to repair defective cylinders. Gages should be checked to ensure that the gas under pressure is not left in hoses when operations are completed.

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6.2.6 Marking

For the purpose of identifying the gas content, compressed gas cylinders shall be legibly marked with either the chemical or trade name of the gas. Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be on the shoulder of the cylinder for easy identification.

6.2.7 Transportation

Transporting gas cylinders requires careful consideration and appropriate precautions. These considerations and precautions include:

- Motor vehicle transport of cylinders
- Flammable gas and oxidizer cylinders transport
- Hand truck (dolly) transport of cylinders
- Cylinder transport precautions

Motor vehicle transport of cylinders shall only be done with vehicles equipped with racks or other means of securing the cylinders. Cylinders containing liquefied hydrogen or toxic gases shall be transported in open body vehicles.

Flammable gas and oxidizer cylinders transport must not be done together nor with poisons or corrosives. However, oxygen and acetylene cylinder joint transport is allowed if:

- The cylinders are transported in the rear truck bed below the cab level
- A roll bar is installed over the rear truck bed to prevent the cylinders from falling out of the truck bed in the event of the vehicle overturning

Red label, yellow label, white label, green label, or poison label materials are not to be transported on the same load. Poison label materials are not to be transported with food or other items intended for human consumption.

Hand truck (dolly) transport of cylinders shall be used for the transfer of compressed gas cylinders from loading area to shop or laboratory or other within-building transfers.

Cylinder transport precautions include:

- Cylinders having the valve protection cover in place while being transported (inter- and intra-building transport)
- Cylinders not being rolled or lifted by the valve or valve cap for moving
- Cylinder valves being shut off and valve caps in place during transit from location to location
- Cylinders that are dropped during transit being taken out of service and returned to the supplier for inspection

- Cylinders being securely supported at all times during transport
- Smoking being prohibited during loading, unloading, and hand transportation of flammable gas cylinders

6.2.8 Storage

The storage of compressed gas cylinders requires some basic precautions and guidelines. These include:

- General cylinder storage precautions
- Specific gas cylinder storage guidelines
- Cylinder storage room guidelines

General cylinder storage precautions include**:**

- Cylinders being secured in an upright position in a safe, dry, well-ventilated place prepared and reserved for the purpose
- Cylinders not being kept in unventilated enclosures such as lockers
- Cylinders not being stored in the same area as flammable substances, such as oil and volatile liquids or near sources of heat, such as radiators or furnaces
- Cylinders not being stored near elevators, gangways, stairwells, or other places where they can easily be knocked down or damaged
- Cylinders being stored on a level fireproof floor
- Cylinders stored in the open being protected from contact with the ground and against extremes of weather
- Cylinder storage being planned so that cylinders are used in the order that they are received from the supplier
- Empty and full cylinders being stored separately, with empty cylinders being plainly identified as such to avoid confusion
- Empty cylinders being grouped together that have held the same contents

Specific gas cylinder storage guidelines includes additional precautions and guidelines for oxygen, hydrogen, and acetylene and liquefied fuel gas cylinders.

Oxygen cylinders should not be stored within 20 feet (6 meters) of highly combustible materials, oil, grease, wood shavings, or cylinders containing flammable gases. (However, for NCDOT operations, oxygen and acetylene are typically paired on a common transfer cart for use.) If closer than 20 feet, cylinders should be separated by a wall with a fire-resistance rating of at least 30 minutes.

Hydrogen cylinders storage locations shall be permanently placarded as follows: “HYDROGEN-FLAMMABLE GAS-NO SMOKING-NO OPEN FLAMES,” or equivalent.

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Acetylene and liquefied fuel gas cylinders should be stored with the valve end up. If storage is within 100 feet (30.5 meters) of each other and not protected by automatic sprinklers, the total capacity of acetylene cylinders stored and used inside the building should be limited to 2,500 ft^3. Acetylene storage areas must be well ventilated and open flames must be prohibited. Acetylene storage rooms should have no other compressed gases.

Cylinder storage room guidelines include:

- Storage rooms for cylinders containing flammable gases being well ventilated to prevent the accumulation of explosive concentrations of gas
- No ignition sources being permitted
- Smoking being prohibited
- All permanent wiring being in conduit
- Electric lights (portable and fixed) being equipped with guards to prevent breakage
- Electric switches being located outside the room

6.2.9 Cylinder Protection

All gas cylinders with a water capacity of over 30 pounds shall be equipped with a valve protection cap or with a collar or recess to protect the valve. In addition, cylinders shall be maintained with the protective cap in place at all times unless in use.

6.2.10 Service

Cylinder service, modifications or repairs will be performed by an authorized individual other than a NCDOT employee. Any damaged or faulty equipment will be repaired or replaced by the service representative. Cylinder valves that cannot be opened by hand will not be forced open with tools and will be returned to the supplier for service.

6.3 Specific Responsibilities

6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase of compressed gas cylinder equipment and related supplies. They will also be responsible for identifying the employees affected by this safety policy and procedure. Managers/Unit Heads will obtain and coordinate the required training for the affected employees.

Managers/Unit Heads will also ensure compliance with this safety policy and procedure through their auditing process.

6.3.2 Supervisors

Supervisors will not allow any employee who has not received the required training to handle any compressed gas cylinders.

Supervisors will also note defective cylinders and tag them for repair.

6.3.3 Employees

Employees shall comply with all applicable guidelines contained in this safety policy and procedure. They shall report any defective or damaged cylinders to their supervisor.

6.3.4 Safety and Loss Control

Safety and Loss Control will provide prompt assistance to managers/unit heads, supervisors, or others as applicable on any matter concerning this safety policy and procedure. Safety and Loss Control will assist in developing or securing the required training.

Safety and Loss Control will also work with Purchasing and Central Equipment Unit to ensure that all newly purchased compressed gas cylinders equipment and supplies comply with current safety regulations and this safety policy and procedure.

Additionally, Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

6.3.5 Central Equipment Unit

Central Equipment Unit will maintain an inventory of related parts and supplies for compressed cylinders.

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APPENDIX A: Compressed Gas Cylinders Safe Handling Guidelines

- Accept only cylinders approved for use in interstate commerce for transportation of compressed gases.
- Do not remove or change the marks and numbers stamped on the cylinders.
- Cylinders must never be dragged, pushed, or pulled across the floor.
- Transport cylinders weighing more than a total of 40 pounds (18.2 kg) on a hand or motorized truck, securing them from falling.
- Keep the cylinders clean and protect them from cuts or abrasions.
- Do not lift compressed gas cylinders with an electromagnet. Where cylinders must be handled by a crane or derrick, as on construction jobs, carry them in a cradle or suitable platform and take extreme care that they are not dropped or bumped. Do not use slings.
- Do not drop cylinders or allow them to strike each other violently.
- Do not use cylinders for rollers, supports, or any purpose other than to contain gas.
- Do not tamper with safety devices in valves or on cylinders.
- Consult the supplier of the gas when in doubt about the proper handling of a compressed gas cylinder or its contents.
- Clearly write EMPTY in chalk on empty cylinders that are to be returned to the vendor.
- Close cylinder valves and replace valve protection caps, if the cylinder is designed to accept a cap.
- Load cylinders to be transported to allow as little movement as possible. Secure them to prevent violent contact or upsetting.
- Always consider cylinders to be full and handle them with corresponding care.
- Securely support compressed gas cylinders at all times. Cylinders must not be left “free-standing” at anytime, e.g., cylinders unloaded from truck to loading dock must be secured until placed on a hand truck for delivery within the building.
- Compressed gas cylinders should never be subjected to a temperature above 125^{0}F.
- Never place cylinders where they might become part of an electrical circuit.
- Do not re-paint cylinders.
- Never use a flame to detect flammable gas leaks. Always use soapy water.

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

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